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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Practice for Collecting Benthic Macroinvertebrates with the Basket Sampler[1]

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1. Scope

1.1 This practice covers procedures for obtaining qualitative and quantitative samples of macroinvertebrates in rivers, streams, lakes, and reservoirs. The device can be used in areas in which no other method is feasible.

1.2 Basket samplers are usually colonized by a wide variety of macroinvertebrates that actively and passively enter the current or the water column.

1.3 The method described in this practice facilitates the standardization of collection procedures at sampling sites and is excellent for water quality monitoring purposes. Standardized sampling is especially desirable when the results from different investigators and environments are to be compared.

1.4 The materials used in the basket sampler are natural or artificial materials of various compositions and configurations. The device is placed in water for a predetermined exposure period and depth for the colonization of macroinvertebrate communities.

1.5 The basket sampler can be used alone or can effectively augment bottom substrate sampling, because many of the physical variables encountered in bottom sampling are minimized (for example, variable depth and light penetration, temperature differences, and substrate types).

1.6 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1129 Terminology Relating to Water[2]

E 1469 Practice for Collecting Benthic Macroinvertebrates with Multiple-Plate Samplers[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, see Terminology D 1129.

4. Significance and Use

4.1 The basket sampler is a highly effective device for evaluating the biological integrity of surface waters and for studying indigenous macroinvertebrate communities **(Refs 1-26)**[4]. Basket samplers are used to collect qualitative and quantitative samples from lentic and lotic waters containing indigenous benthic macroinvertebrates living on various types of substrates.

4.2 Physical factors such as stream velocity and depth may variably affect the degree of colonization. The sampling method is selective for drifting organisms (biased for insects) and for those that preferentially attach to or live on hard surfaces.

4.3 Basket samplers are excellent for water quality monitoring; contain uniform substrate types at each station for better comparison; provide quantitatively comparable data; contain negligible amounts of debris, permitting quick laboratory processing; and usually do not require additional weight for stability.

4.4 Basket samplers sample a known area at a known depth for a known exposure period. Basket samples provide no measure of the biota and condition of the natural substrate at a station. They record only biota accumulated during the exposure period.

4.5 The organisms in the sampler are used to define macroinvertebrate community characteristics in water quality studies and ecological assessments.

5. Description of Sampler

5.1 The type of basket sampler normally used (Fig. 1) is a cylindrical "barbecue" basket 11 in. (28 cm) long and 7 in. (17.8 cm) in diameter that is filled with approximately 17 lb (7.7 kg) of natural rocks varying from 1 to 3 in. (2.5 to 7.6 cm) in diameter **(16, 17)**. A hinged door on the side provides access to the contents. An estimated 3.2 ft^2 (0.3 m^2) of surface area is provided for colonization by macroinvertebrates. A ⅛-in. (3.2-mm) wire cable is passed through the long axis of the

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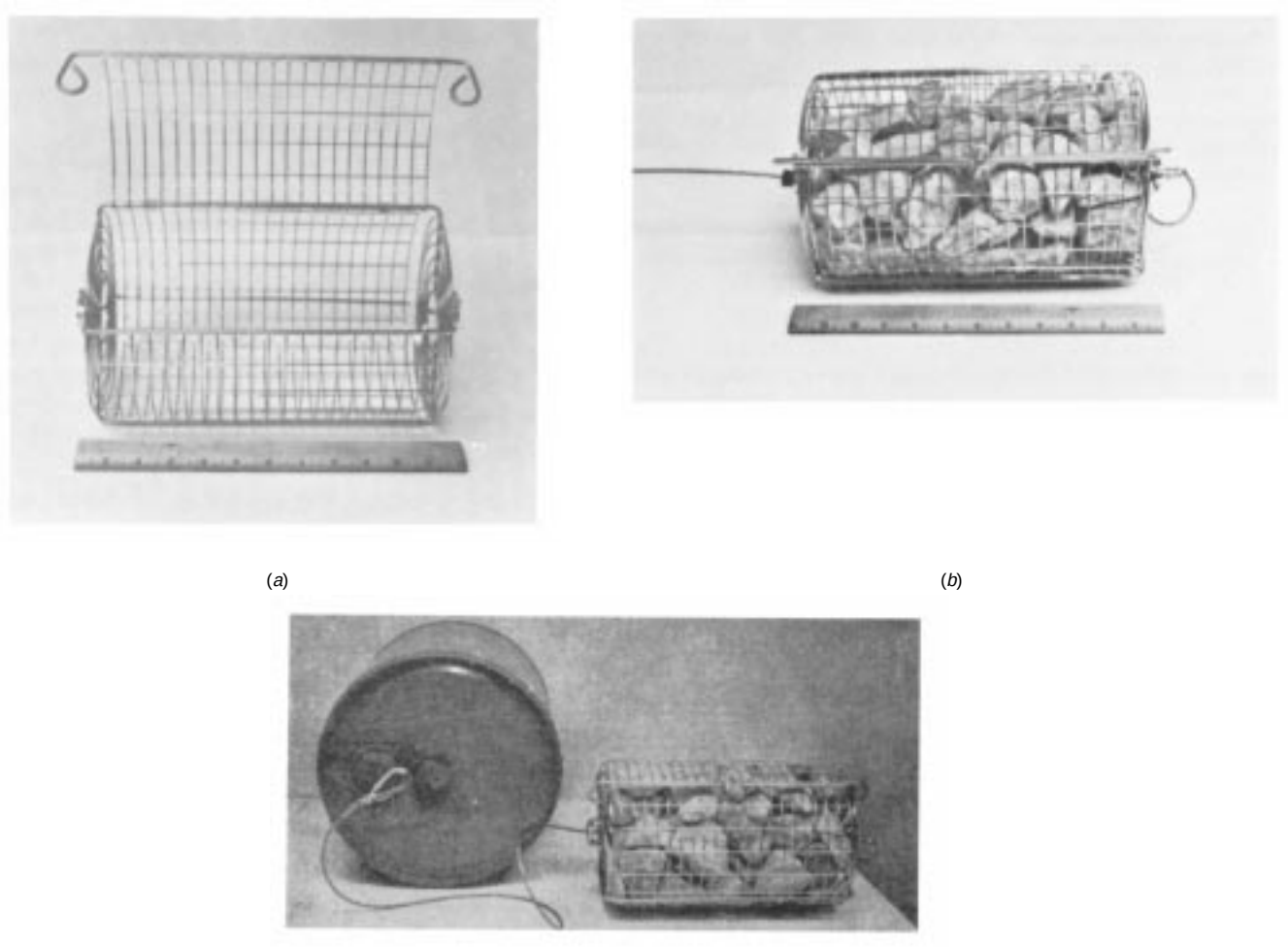
[2] *Annual Book of ASTM Standards*, Vol 11.01.

[3] *Annual Book of ASTM Standards*, Vol 11.05.

[4] The boldface numbers in parentheses refer to the list of references at the end of this practice.



(*a*) (*b*)

(*c*)

FIG. 1 Cylindrical "Barbecue" Basket Sampler: (A) Basket Sampler Empty; (B) Basket Sampler Containing Limestone Rocks and Ready for Installation; and (C) Basket Sampler Containing Limestone Rocks and Attached to 5-gal (19-L) Metal Container Filled with Polyurethane Foam. (Barbecue Baskets Available from Tenaco, 2007 NE, 27th Ave., Gainesville, FL 32609 or W.C. Bradly Enterprises, Inc., P.O. Box 1240, Columbus, GA 32993.)

basket; one end is fastened with a cable clamp, and the other end is fixed to the float. A5-gal (19-L) metal container filled with polyurethane foam can be used as a float. A ⅜-in. (9.5-mm) steel rod threaded at each end is passed through the long axis of the float and fastened at each end by nuts. Three inch by 1⅛by ⅛-in. (25.6 by 3.2-mm) strap iron serves as a swivel at each end, secured on the rods by nuts. The wire cable used to suspend the basket is attached to the swivels by holes drilled for that purpose. The float can be attached to a stationary structure, or the basket can be anchored to the bottom in shallow water.

5.2 The rugged construction of the sampler is heavy enough to resist movement by water currents. Samples usually contain negligible amounts of extraneous material, permitting rapid laboratory processing.

5.3 A collapsible type of basket sampler has been used for comparing populations surrounding rocky substrates **(7)**. The sampler consists of a collapsible basket surrounded by a nylon netting bag that can be loaded with materials simulating the natural substrate on which it lies. A rim around the top helps retain the substrate material. When lowered to the bottom, the basket sampler collapses to form a substrate area that is eventually colonized. When the basket is raised off the bottom, the basket extends to its original hemispherical shape, and the surrounding net bag prevents the loss of invertebrates during retrieval.

6. Precautions

6.1 Samplers and floats may be difficult to anchor; they may be a navigation hazard.

6.2 Samplers are susceptible to vandalism and often lost.

6.3 Recovery techniques are critical for ensuring the collection of all organisms retrieved in the sampler.

6.4 Caution should be exercised in the reuse of samplers that may be subjected to contamination by toxicants, chemicals, oils, etc.

7. Procedures

7.1 In deep water, three basket samplers are suspended from floats, cement structures, or rods driven into the stream-bed or

lake-bed and positioned well up in the euphotic zone of good light penetration (1 to 3 ft (0.3–0.9 m)) for maximum abundance and diversity of the macroinvertebrates. A4-ft (1.2-m) depth is acceptable unless the water is exceptionally turbid.

7.2 The optimum period for substrate colonization is six weeks for most types of water. Three replicate samples at each station are an absolute minimum.

7.3 For uniformity of depth, suspend the basket samplers from floats on ⅛-in. (3.2-mm) steel cable. If vandalism is a problem, use subsurface floats or put the samplers on supports placed on the bottom. Regardless of the installation technique, use uniform procedures (for example, the same depth and exposure period, sunlight, current velocity, and habitat type).

7.4 At shallow water stations (less than 4 ft (1.2 m) deep), install the samplers so that the exposure occurs midway in the water column at low flow. The samplers may be installed in pools, runs, or riffles suspended below the water surface. The collections should be as representative of the reach as possible by ensuring that the samplers are not close to the bank.

7.5 In streams up to a few metres in width, install the device at approximately midstream. In larger streams, install the device at approximately one quarter of the total width from the nearest bank.

7.6 If the samplers are installed in July when the water depth is approximately 4 ft (1.2 m) and the August average low flow is 2 ft (0.6 m), the correct installation depth in July is 1 ft (0.3 m) above the bottom. The sampler will receive sunlight at optimum depth (1 ft (0.3 m)) and will not be exposed to air anytime during the sampling period. Care should be exercised not to allow the sampler to touch bottom, which may permit siltation, thereby increasing the sampling error.

7.7 In shallow streams with sheet rock bottoms, basket samplers can be secured to ⅜-in. (0.95-cm) steel rods that are driven into the substrate or secured to rods that are mounted on low, flat, rectangular blocks half way between the water surface and the stream bed. However, these must be anchored securely to the rock bottom to avoid loss during floods.

7.8 Factors such as the time of the year and the body of water sampled should be considered in the determination of exposure time. The exposure time should be consistent among sites during the study. If study time limitations reduce this period, the data must be evaluated with caution, and in no case should data be compared from samplers exposed for different time periods.

7.9 Samplers must be protected from loss of invertebrates during retrieval. Most insects rapidly leave the sampler when disturbed; thus a retrieval method to prevent their escape must be used.

7.10 In shallow water, approach the basket samplers from downstream, lift the sampler quickly, and place the entire sampler in a polyethylene bag or jug containing 10 % formalin or 80 % ethanol. The fixative, formalin, should be used only if the specimens collected require special processing for identification. Once the sampler is touched, it must be removed from the water immediately or many of the animals will leave the sampler. If the sampler must be disturbed during the recovery process so that it cannot be lifted straight up out of the water, a net should be used to enclose the sampler before it is disturbed.

7.11 To accomplish this, the rock-filled basket sampler should be enclosed either in a sieving bucket with U.S. Standard No. 30 sieve screen or by a dip net constructed of U.S. Standard No. 30 sieve or finer mesh bolting cloth that can be pulled around the sampling device before retrieval. Also, samplers exposed in deep water may be enclosed in a retrieval net and brought to the surface by divers. If the sampler can be pulled quickly from the water without undue disturbance, as described in 7.10, it may not be necessary to enclose it.

7.12 The organisms can be removed in the field by disassembling the sampler in a tub or bucket partially filled with water and scrubbing the rocks with a soft-bristle brush to remove clinging organisms. The contents of the bucket are then poured through a No. 30 or 60 sieve and washed into a jar and preserved with 10 % formalin or 80 % ethanol. If the organisms are not removed in the field, the basket samplers can be taken to the laboratory and disassembled if placed in a water-tight container containing a fixative or preservative. The samples must be labelled with at least the location, habitat, date, and time of collection.

7.13 Cleaned basket samplers can be reused unless there is reason to believe that contamination by toxicants (for example, chemicals or oils) has occurred. These substances may be toxic to the macroinvertebrates or may inhibit colonization. Do not reuse a basket sampler substrate that has been exposed to preservatives.

8. Keywords

8.1 aquatic habitats; artificial substrate; basket sampler; bioassessment; colonization; macroinvertebrates; pollution; sampling device

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